

# *Montana Comprehensive Assessment System (MontCAS CRT)*

GRADE 10  
COMMON RELEASED ITEMS  
SPRING 2016



[opi.mt.gov](http://opi.mt.gov)

Montana  
**Office of Public Instruction**  
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# Science Directions

This Science test contains three test sessions. Mark or write your answers in the Answer Booklet. Use a pencil to mark or write your answers.

This test includes two types of questions: multiple-choice and constructed-response questions.

For the multiple-choice questions, you will be given four answer choices—A, B, C, and D. You are to choose the correct answer from the four choices. Each question has only one answer. After you have chosen the correct answer to a question, find the question number in your Answer Booklet and completely fill in the circle for the answer you chose. Be sure the question number in the Answer Booklet matches the question number in the Test Booklet. The example below shows how to completely fill in the circle.

CORRECT MARK	INCORRECT MARKS
<input checked="" type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input checked="" type="radio"/>

If you decide to change your answer to a question, erase the wrong mark completely before filling in the circle of the new answer. Be sure you have only one answer marked for each question. **If two circles are bubbled in for the same question, that question will be scored as incorrect.**

If you are having difficulty answering a question, skip the question and come back to it later. Make sure you skip the circle for the question in your Answer Booklet.

For the other types of questions in the Test Booklet, you will be asked to write your answers in the box provided. Read the question carefully. If a question asks you to explain your answer or to show your work, be sure to do so.

You may make notes or use highlighters in your Test Booklet, but you must bubble or write your final answers in your Answer Booklet. **Do not make any stray or unnecessary marks in your Answer Booklet.**

Let's work through a sample question together to be sure you understand the directions.

## Sample Question

1. What is the state animal of Montana?
  - A. elephant
  - B. giraffe
  - C. grizzly bear
  - D. zebra

# Science

1. Which sentence describes the big bang theory?
  - A. The universe was created by expansion from a central dense point.
  - B. The solar system was created when the Sun exploded as a supernova.
  - C. Earth was created from the collision of two larger planets.
  - D. The Moon was created from the impact of an asteroid on Earth.
2. Which step in protein synthesis happens first?
  - A. A new protein is assembled at the ribosome.
  - B. A new strand of mRNA is made from DNA.
  - C. tRNAs bring the correct amino acids to mRNA.
  - D. mRNA moves from the nucleus to the ribosome.
3. Some fossils found in older rock layers have never been seen by geologists in younger rock layers. Which reason **best** explains why these fossils are absent in younger rocks?
  - A. The younger rocks are in areas that are hard to reach by geologists.
  - B. The younger rocks preserve the fossils differently than the older rocks.
  - C. The organisms that made the fossils became extinct before the newer layers formed.
  - D. The organisms that made the fossils became adapted for living in a different environment.
4. A student wants to design an experiment to measure how long it takes for 10 g of sugar to dissolve in 100 mL of water at 30°C. Which tools will provide the **most** accurate results?
  - A. 10 g weight, beaker, metric ruler, stopwatch, thermometer
  - B. balance, graduated cylinder, source of heat, stopwatch, thermometer
  - C. balance, clock, glass container, source of heat, thermometer
  - D. 10 g weight, clock, metric ruler, source of heat, test tube

5. A student wants to know which breed of dog is the most intelligent. The student calculates the percentage of dogs from different breeds that graduate from a guide dog school. Data was collected for 2000 dogs. The results are shown in the table below.

**Guide Dog School Graduates**

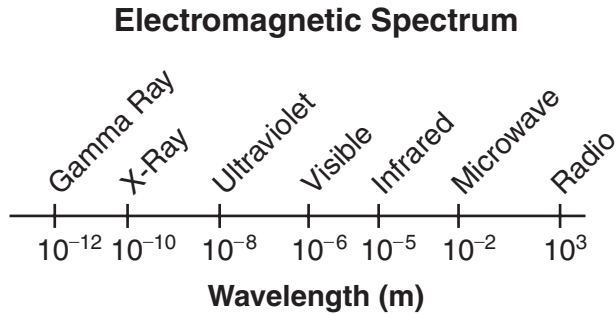
Breed	Percent of Guide Dogs
Labrador retriever	56
Golden retriever	12
German shepherd	14
Other breeds and mixed breeds	18

The student concluded that Labrador retrievers are the most intelligent dogs. Which flaw in the student's experimental design affects the validity of these results?

- A. The student did not consider other factors that make a good guide dog.
- B. The student did not consider personal preferences of dog breeders.
- C. The student did not collect data about the opinions of the dogs' owners.
- D. The student did not collect enough data to have a reliable sample size.

6. Animals such as elk, beavers, and birds depend on quaking aspen trees for survival. Which statement describes how the carbon cycle connects the quaking aspen trees and the animals that depend on the trees for survival?
- A. The trees create carbon that the animals use to make strong bones.
  - B. The trees convert carbon from the atmosphere into usable energy for the animals.
  - C. The trees remove carbon from the animals and transfer it to the soil through the tree roots.
  - D. The trees trap oxygen in their leaves and release carbon dioxide that the animals breathe.
7. Which tools are used by meteorologists?
- A. meterstick, graduated cylinder, stopwatch
  - B. microscope, slide, cell stains
  - C. barometer, thermometer, anemometer
  - D. telescope, star chart, satellites

8. The diagram below shows the electromagnetic spectrum.



A scientist detects an electromagnetic wave with a wavelength of  $3.0 \times 10^{-4}$  m. How do the wavelength and energy of this wave compare to the wavelength and energy of visible light?

- A. This wave has a longer wavelength and lower energy than visible light.
- B. This wave has a longer wavelength and higher energy than visible light.
- C. This wave has a shorter wavelength and lower energy than visible light.
- D. This wave has a shorter wavelength and higher energy than visible light.

9. A student compares four different soil samples to determine which type of soil holds the most water. He follows the procedure in the box below.

- 1. Fill four identical 500 mL beakers halfway with a different soil sample.
- 2. Add a small amount of water to each beaker and wait for it to be absorbed by the soil.
- 3. Add more water to each beaker and wait for it to be absorbed.
- 4. Repeat step 3 until each beaker has water standing above the top of the soil.

Why did the procedure **not** help the student determine which type of soil held more water?

- A. The student should have used more soil samples.
- B. The student should have used much larger containers.
- C. The student should have measured the amount of water that was used.
- D. The student should have taken the temperature of each soil sample before adding water.

10. A girl and her sled have a combined mass of 30 kg. At the top of an icy hill, they have a potential energy of 1500 J. What will be their kinetic energy at the bottom of the hill?
- 500 J
  - 1000 J
  - 1500 J
  - 2000 J

11. A section of the periodic table is shown below.

		<div>2 — Atomic number</div> <div><b>He</b> — Symbol</div> <div>4.003 — Atomic mass</div>
<div>8</div> <div><b>O</b></div> <div>15.999</div>	<div>9</div> <div><b>F</b></div> <div>18.998</div>	<div>10</div> <div><b>Ne</b></div> <div>20.180</div>
<div>16</div> <div><b>S</b></div> <div>32.066</div>	<div>17</div> <div><b>Cl</b></div> <div>35.453</div>	<div>18</div> <div><b>Ar</b></div> <div>39.948</div>
<div>34</div> <div><b>Se</b></div> <div>78.96</div>	<div>35</div> <div><b>Br</b></div> <div>79.904</div>	<div>36</div> <div><b>Kr</b></div> <div>83.80</div>

According to the periodic table, which element has chemical properties **most** similar to fluorine (F)?

- helium (He)
- oxygen (O)
- neon (Ne)
- bromine (Br)

12. Which information is provided by the binomial nomenclature system when used to name newly discovered organisms?
- the age of a species
  - the ancestry of a species
  - the relatedness of a species
  - the environment where a species lives

13. Which scientific tool is used to measure the width of the nucleus in a human cheek cell?
- calculator
  - dissecting microscope
  - hand lens
  - light microscope

14. Which statement **best** compares photosynthesis and respiration in plants and animals?
- Plants use photosynthesis to capture energy; animals use respiration to release energy.
  - Plants use photosynthesis to capture energy; both plants and animals use respiration to release energy.
  - Plants use photosynthesis to release energy; animals use respiration to capture energy.
  - Plants use photosynthesis to release energy; both plants and animals use respiration to capture energy.

15. A person wears a winter coat filled with down feathers. How do the down feathers help keep the person warm?
- A. They convert electromagnetic energy from the Sun to heat energy that circulates within the coat.
  - B. They trap pockets of air that prevent heat energy from leaving the person's body.
  - C. They create static electricity that conducts heat energy to the person's body.
  - D. They absorb kinetic energy that traps heat energy within the coat.
16. A renewable energy company is investigating sites for a new wind farm. Which information collected at each site will provide the **most** valid data to support a decision about where to build the new wind farm?
- A. the number of people who live nearby
  - B. the amount of electricity that is used by people nearby
  - C. the amount of wind that blows night and day throughout a year
  - D. the number of wind turbines that can be built within the proposed budget
17. Which organelle found in **both** animal and plant cells can a student see with a light microscope?
- A. cell wall
  - B. chloroplast
  - C. flagellum
  - D. nucleus
18. Scientists have discovered a new single-celled organism living at the bottom of a lake in Antarctica. Which procedure would **best** allow the scientists to classify this organism as either a prokaryote or a eukaryote?
- A. studying the growth of the cells in the absence of oxygen
  - B. determining if the genetic material of the cell is made of DNA or RNA
  - C. isolating the cell membrane to determine if lipids are present
  - D. viewing samples of whole cells to study internal cell structures



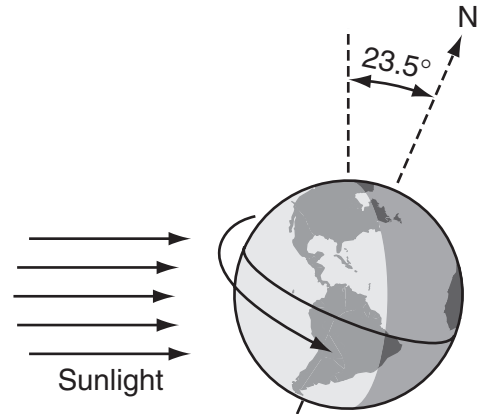
19. Many trees on the mountains in Montana have a waxy coating on their leaves. Which process caused so many different species of trees to share this common feature?

- A. artificial selection
- B. cross-pollination
- C. natural selection
- D. self-pollination

20. The date when lilac and honeysuckle bushes first bloom in Montana is directly related to the timing of the first rush of snowmelt from the mountains. How will lilac and honeysuckle bushes **most likely** be affected by a slightly cooler average spring temperature?

- A. They will bloom later than usual, because the snow will melt later than usual.
- B. They will not bloom until fall, because the snow will take all summer to melt.
- C. They will not survive, because all the snow will melt at one time and cause flooding.
- D. They will bloom at the usual time, because weather has no effect on the timing of snowmelt.

21. Earth is tilted 23.5 degrees in its orbit around the Sun, as shown in the diagram below.



Which effect does the tilt of Earth cause?

- A. continental drift
- B. global warming
- C. the depletion of the ozone layer
- D. the changing of the seasons

22. The table below represents a partial classification of vertebrate classes.

Vertebrate Class	Locomotion
Fish	Swim
Amphibians	Swim/walk
Reptiles	Swim/walk
Birds	Swim/walk/fly
Mammals	Swim/walk/fly

Why do vertebrates use many different types of locomotion?

- A. Their populations have adapted to breathing air.
- B. Their populations have adapted to many different ecosystems.
- C. Each class lives in one particular kind of ecosystem.
- D. Each class has a different kind of appendage than the others.

23. Which structure is common to bacteria and plant cells, may be viewed with a light microscope in plant cells, and is composed mostly of carbohydrates?

- A. cell wall
- B. Golgi apparatus
- C. mitochondrion
- D. nucleus

24. In what form does energy enter an animal cell to provide energy for cell processes?

- A. light energy from the Sun
- B. chemical energy from food molecules
- C. heat energy from the animal's environment
- D. mechanical energy from the animal's movement

25. Lithium has an atomic number of 3 and an average atomic mass of 6.941. How many electrons does a neutral lithium atom contain?

- A. 3
- B. 4
- C. 7
- D. 10

26. According to the nebular theory, which factor caused small objects in space to grow into planets?

- A. condensation of gases
- B. gravitational pull
- C. nuclear explosions
- D. solar radiation

27. What is the **biggest** difference between protons and neutrons?

- A. Protons and neutrons have different electric charges.
- B. Neutrons exert a stronger nuclear force than protons.
- C. A proton's mass is more than 10 times a neutron's mass.
- D. A neutron's mass is more than 10 times a proton's mass.

28. Students observed that the soil in their school yard consisted of three different layers. They wanted to investigate which layer of soil would be best for growing plants. They designed the following procedure:
1. Collect a soil sample from each layer.
  2. Place each soil sample in a different pot.
  3. Plant one radish seed in each pot.
  4. Place two pots on a windowsill and the other pot in a closed cabinet.
  5. Pour 10 mL of water into each pot every day.
  6. Ask a local gardener what the outcome of the experiment should be, and use the gardener's opinion as the conclusion.
- a. Describe two strengths of this experiment.
  - b. Describe two weaknesses of this experiment. For each weakness, describe what the students could do to correct the weakness.

## Scoring Guide

Score	Description
4	Response demonstrates a thorough understanding of experimental design. Response describes two strengths and two weaknesses of the design. For each weakness the student suggests a correction. Response contains no errors or omissions.
3	Response demonstrates a general understanding of experimental design. Response describes two strengths and two weaknesses of the design. For each weakness the student suggests a correction. Response contains one error or omission.
2	Response demonstrates a limited understanding of experimental design. Response describes two strengths and two weaknesses of the design. For each weakness the student suggests a correction. Response contains two errors or omissions.
1	Response demonstrates a minimal understanding of experimental design. Response describes two strengths and two weaknesses of the design. For each weakness the student suggests a correction. Response contains one correct piece of information and contains several errors or omissions.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response.

### Training Notes

Strengths of the design: (any two) 2 points

1. Three types of soil are in three different pots.
2. The same type of seed was planted in each pot.
3. The plants received the same amount of water.

Weaknesses of the design and a possible correction: (any two) 2 points

1. There is no indication of a hypothesis. The students need to write a hypothesis first.
2. Light was a variable in addition to the soil types. All the pots should have the same amount of light.
3. The conclusion should come from their results, not the opinion of someone else. The students should use their data to draw a conclusion.
4. The procedure did not state how many pots of each type of soil was used. It is best to replicate the procedure.
5. The students only planted one seed in each pot. The students should plant several seeds in each pot, or they should germinate the seeds first and then plant several germinated seeds in each pot.
6. The students did not measure the amount of soil in each pot. All the pots should have the same amount of soil.

#### Example of Score Point 4

a) This experiment involves some strengths in the experimental procedure. Two strengths in the experiment are the decisions to: place each soil sample in a different pot, and to pour 10mL of water into each pot every day. These steps allow the experiment to be done in a controlled environment, and help to produce accurate results. b) This experiment also involves weaknesses in the experimental procedure. Two weaknesses in the experiment are the decisions to: place two pots on a windowsill and the other pot in a closed cabinet; and to base a gardener's opinion of the experiment as the conclusion. Each pot should be placed in the same environment to insure accurate results, and observations should be recorded as data to conclude accurate results and not false data.

### Example of Score Point 3

Ⓐ There are several strengths in this plant procedure. One is that they use a radish plant in each pot which makes it a constant. Another one is they water the plant 10 mL of water everyday to each plant so each plant has the same amount.

Ⓑ There are several weaknesses for this experiment to. First, they put two plants on a windowsill and only one in the closet. They should have put two on the windowsill and two in the closet. Another is they asked a local gardener what the outcome of the experiment should be, and used the gardener's opinion as the conclusion. They should have waited or asked a biologist instead of just getting an opinion from a gardener, they needed to get some facts not opinions.

### Example of Score Point 2

A. There collecting soil from each layer  
Putting them in different pots

B. Placing pots on the window  
they should set them all not just two

### Example of Score Point 1

The two strengths of the experiment are to pour 10mL of water into each pot everyday. The other strength is place two pots on a windowsill and the other pot in a closed cabinet. The two weakness of the experiment are collect a soil sample from each layer and place each soil sample in a different pot.

### Example of Score Point 0

1. Two strengths



